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# Strategy 7: Use Logical Reasoning *(cont.)*

## Problem 3 – On your Own

### Materials:

- ◆ Student activity (page 60)

Sample use of logic chart (includes solution):

	Carl	Joe	Mike	Stan
Ann	x	√	x	x
Enid	x	x	x	√
Gloria	x	x	√	x
Phyllis	√	x	x	x

## Problem 4

### Materials:

- ◆ Student activity (page 60)

Students can use the properties of addition and multiplication to solve this problem. Be sure they understand that the numbers AC and CE are 2-digit numbers, not 1-digit numbers that should be multiplied.

**Possible method of reasoning:** Since  $A \times C = C$ ,  $A = 1$  or  $C = 0$ , because  $1 \times C = C$ , or  $A \times 0 = 0$ . A might equal 1, but C cannot equal 0. This is because  $B + B = B \times C$ , and if  $C = 0$ , then  $B + B = B \times 0$ , or  $B + B = 0$  means B would also have to equal 0. Therefore,  $A = 1$ . Since  $B + B = B \times C$ ,  $C = 2$ , because adding a number to itself is the same as multiplying by 2. From  $CE \div E = E$ , you know that  $E \times E = CE$  because the opposite of division is multiplication. This means that  $E \times E$  equals a 2-digit number with a 2 in the tens place, since  $C = 2$ . The only number that can be multiplied by itself to give a 2 in the tens place is 5:  $5 \times 5 = 25$ . Therefore,  $E = 5$ . Substituting the known values of A, C and E into the first equation shows that  $B = 4$  and  $D = 3$ .

$$A + B = C + D = E$$

$$1 + B = 2 + D = 5$$

$$1 + 4 = 2 + 3 = 5$$

Once students have found values for all the letters, have them substitute the values into the equations to check that they are correct.

**Solution:**  $A = 1$ ,  $B = 4$ ,  $C = 2$ ,  $D = 3$ ,  $E = 5$

Discuss with students how they found their solution. For example, ask students which letter they figured out first. Then have students explain how they found its value.

### Challenge:

The letters F, G and H each stand for a different digit from 6–9. Use the following equations and the values of the letters A, B and D from Problem 4 to find the values of F, G and H.

$$F^2 = HB$$

$$DG \times D = AAA$$

$$(F = 8, G = 7, H = 6)$$

Name:

Date:

# Use Logical Reasoning (cont.)

## On your Own

Use logical reasoning to solve the problems.

### Problem 3



Four married couples are friends. Their names are Carl, Joe, Mike, Stan, Ann, Enid, Gloria and Phyllis. Using the clues below, match each husband and wife.



#### CLUES

- a. Mike is allergic to animals.
- b. Ann is Carl's sister.
- c. Two men went on diets. Carl lost more weight than Gloria's husband.
- d. Enid's husband never had a weight problem.
- e. Ann and Phyllis groom pets in their own homes.
- f. Carl and Stan are brothers.
- g. Stan's weight has been exactly 70 kilograms since he was married.

	Carl	Joe	Mike	Stan
Ann				
Enid				
Gloria				
Phyllis				

### Problem 4



In the equations, each letter stands for a different digit from 0–9. The letters are used to form 1- and 2-digit numbers. A letter stands for the same digit wherever it appears. What digits do the letters stand for?

$$A + B = C + D = E$$

$$A \times C = C$$

$$AC \div B = D$$

$$CE \div E = E$$

$$B + B = B \times C$$



# Strategy 8: Work Backwards

## Learning Objectives

- ◆ Determine reverse steps or actions in a problem
- ◆ Use inverse operations to deduce a starting point

## Problem 1

### Materials:

- ◆ Student activity (page 62)

## Questions

Read each question aloud. Then work through the question with students.

a. (600 people)

Have students reread the problem to help them answer the question. Guide them to see that 100 people entered when the doors opened. If 500 more people than that enter each hour, then 600 people entered during the first hour.

b. (700 people)

Help students see that since 100 people entered when the doors opened, and  $100 + 500$ , or 600, people entered during the first hour,  $100 + 600$  people were in the stadium 1 hour after the doors opened.

c. (1900 people)

Help students see that since 700 people were in the stadium 1 hour after the doors opened,  $700 + 500$  people entered during the second hour. Students can add  $700 + 700 + 500$  to answer the question.

d. (Answers will vary. Sample answers: no, because it is 8 hours from noon to 8.00 p.m., and it will take less than 8 hours for 9100 people to arrive; yes, because it will take more than 8 hours for 9100 people to arrive) Encourage students to find the number of hours that pass from noon to 8.00 p.m. (8 hours)

## Apply the Strategy

To work through the problem, students should first list the number of people that arrive in each hour, until a total of 9100 people is reached. Because the problem states that the game began at 8.00 p.m., students can count back the hours from 8.00 p.m. to find the time the doors opened. For example:

doors open	100 enter		4 p.m.
hour 1	600 enter	700 in stadium	5 p.m.
hour 2	1200 enter	1900 in stadium	6 p.m.
hour 3	2400 enter	4300 in stadium	7 p.m.
hour 4	4800 enter	9100 in stadium	8 p.m.

Students can check their answers by working forward from 4.00 and adding the appropriate number of people per hour.

**Solution:** 4.00 p.m.

e. (Answers will vary. Sample answer: Work forward again from 4.00 p.m. to 8.00 p.m.)

Name: \_\_\_\_\_

Date: \_\_\_\_\_

# Work Backwards

## Problem 1



When the doors opened for the championship basketball game, 100 people entered the stadium. During each hour after that, the number of people who entered was 500 more than the number already in the stadium. At 8.00 p.m., when the game began, there were 9100 people in the stadium. At what time did the doors open?



### Questions

- How many people entered the stadium during the first hour? \_\_\_\_\_
- How many people were in the stadium 1 hour after the doors opened? \_\_\_\_\_
- How many people were in the stadium 2 hours after the doors opened? \_\_\_\_\_
- Do you think the doors opened before noon? Why or why not? \_\_\_\_\_  
\_\_\_\_\_

### Apply the Strategy

You can work forwards and backwards to solve the problem. First work forwards. Figure out how many people entered during each hour. Then work backwards from the time the game began to find the solution.

**Solution** \_\_\_\_\_

- How can you check your solution to be sure it is correct? \_\_\_\_\_